

(12) **United States Patent**
Sieberth et al.

(10) **Patent No.:** **US 9,239,150 B2**
(45) **Date of Patent:** **Jan. 19, 2016**

(54) **LINEAR LIGHTING DEVICE**

USPC 362/221–225, 217.1–217.17,
362/249.01–249.02, 362, 368,
362/217.01–217.06

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See application file for complete search history.

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ABSTRACT

A linear lighting device includes a body, a light source holder, and a light source. The body has a top portion, a bottom portion, and a rear portion. The light source holder has a holding member and an attachment member. The attachment member of the light source holder is secured to the rear portion of the body. Further, the light source is disposed on the holding member of the light source holder. A lighting device also includes a cover. The cover has a first end and a second end, and is movable between an open position and a closed position. The first end of the cover is pivotably secured to the bottom portion of the body and the second end of the cover is adapted to be fixedly secured to the top portion of the body.

44 Claims, 8 Drawing Sheets

(21) Appl. No.: **13/842,012**

(22) Filed: **Mar. 15, 2013**

(65) **Prior Publication Data**

US 2014/0268765 A1 Sep. 18, 2014

(51) **Int. Cl.**

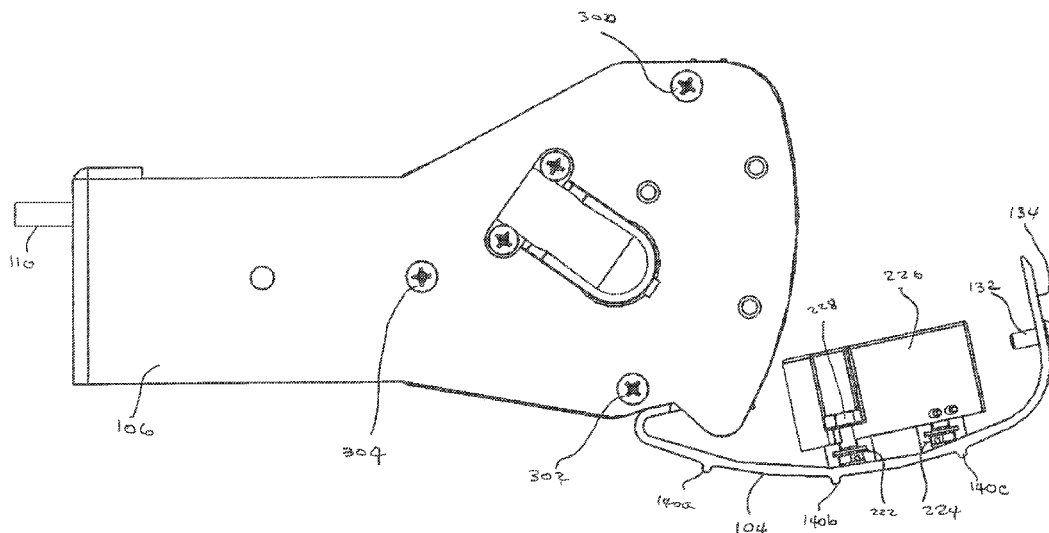
F21V 21/00 (2006.01)
F21S 4/00 (2006.01)
F21V 15/01 (2006.01)
F21V 29/507 (2015.01)
F21V 23/00 (2015.01)
F21V 29/503 (2015.01)
F21V 29/508 (2015.01)
F21Y 101/02 (2006.01)
F21Y 103/00 (2006.01)

(52) **U.S. Cl.**

CPC **F21V 15/01** (2013.01); **F21V 23/009**
(2013.01); **F21V 29/503** (2015.01); **F21V**
29/507 (2015.01); **F21V 29/508** (2015.01);
F21Y 2101/02 (2013.01); **F21Y 2103/003**
(2013.01)

(58) **Field of Classification Search**

CPC **F21V 15/01**; **F21V 29/507**; **F21V 29/503**;
F21V 23/009; **F21V 29/508**; **F21Y 2103/003**;
F21Y 2101/02



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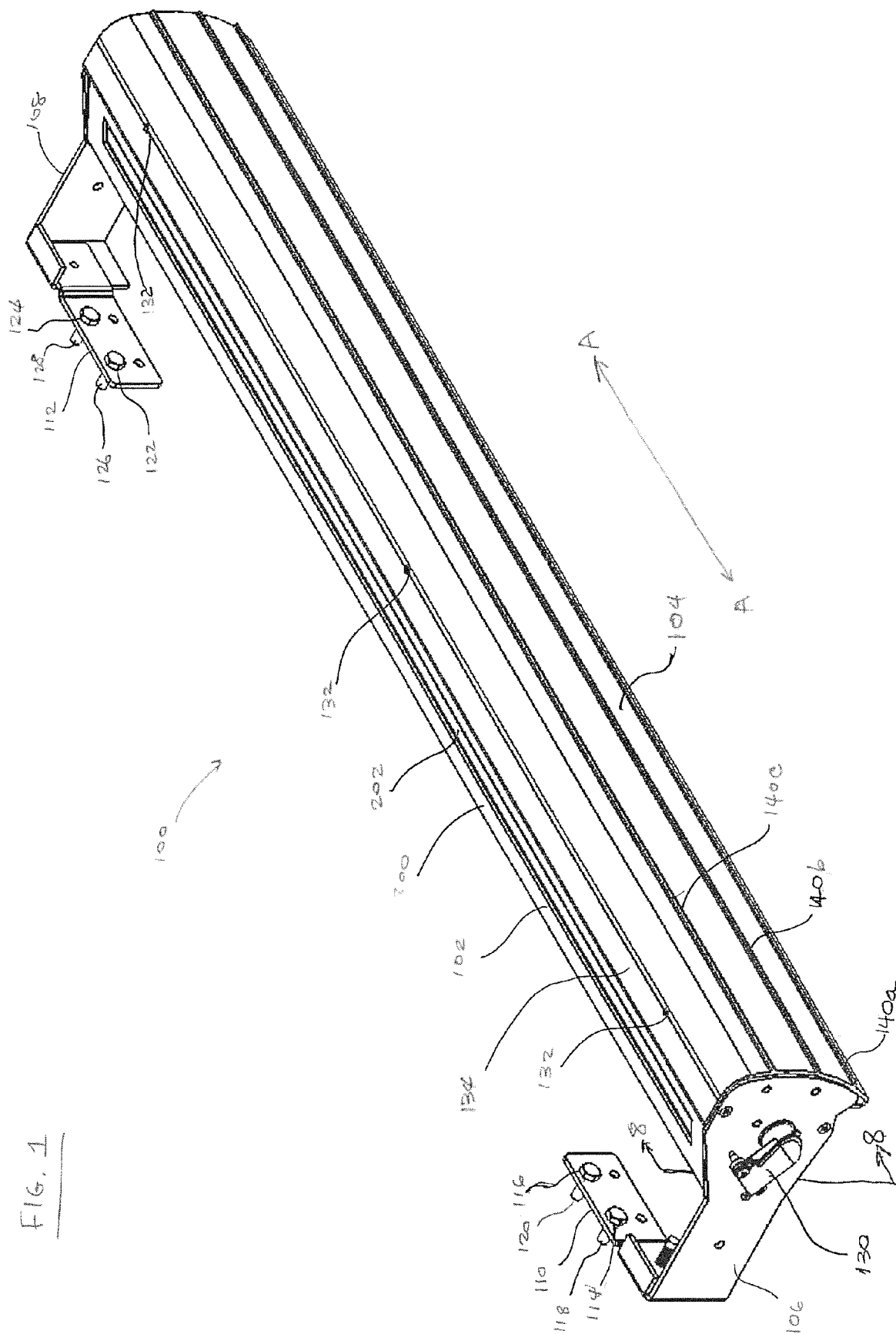
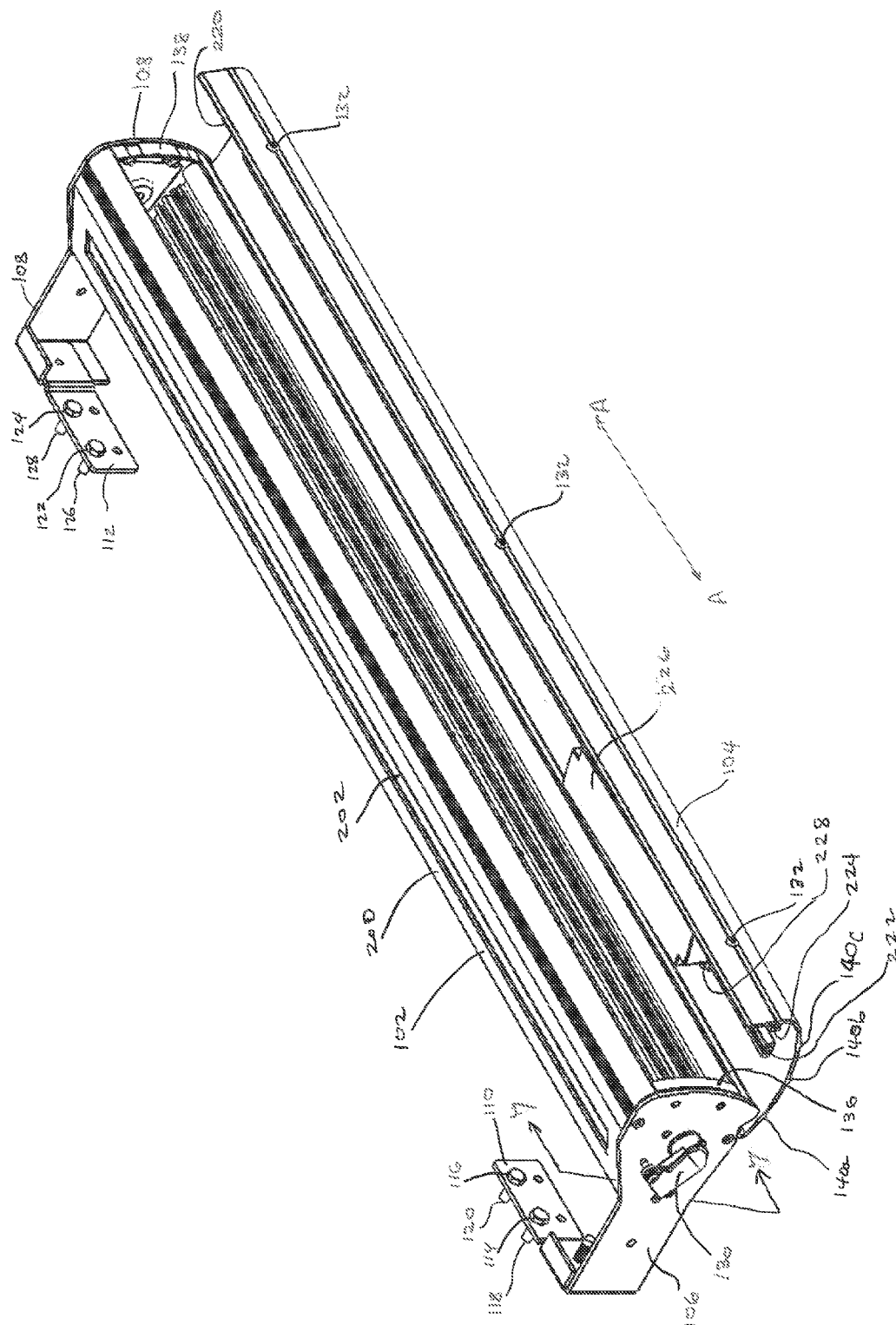


FIG. 1

FIG. 2



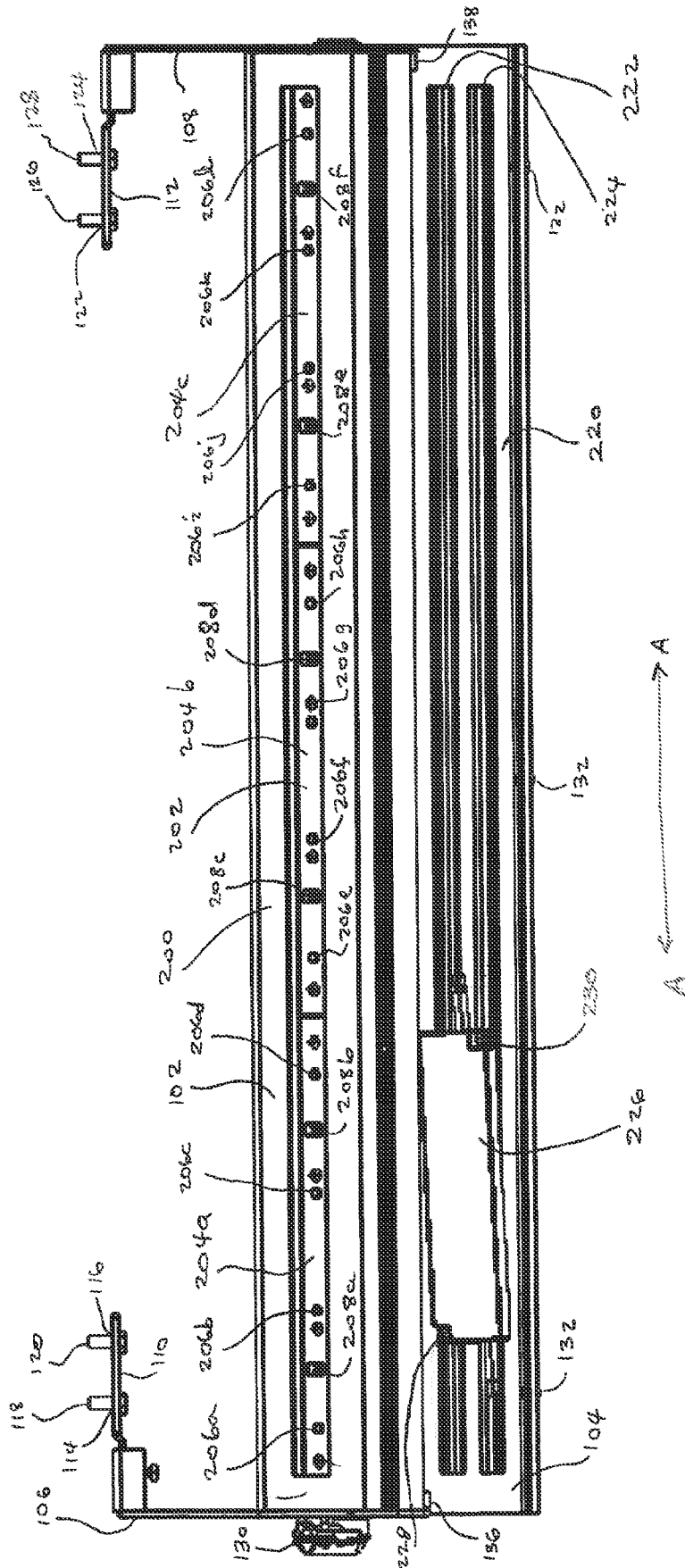
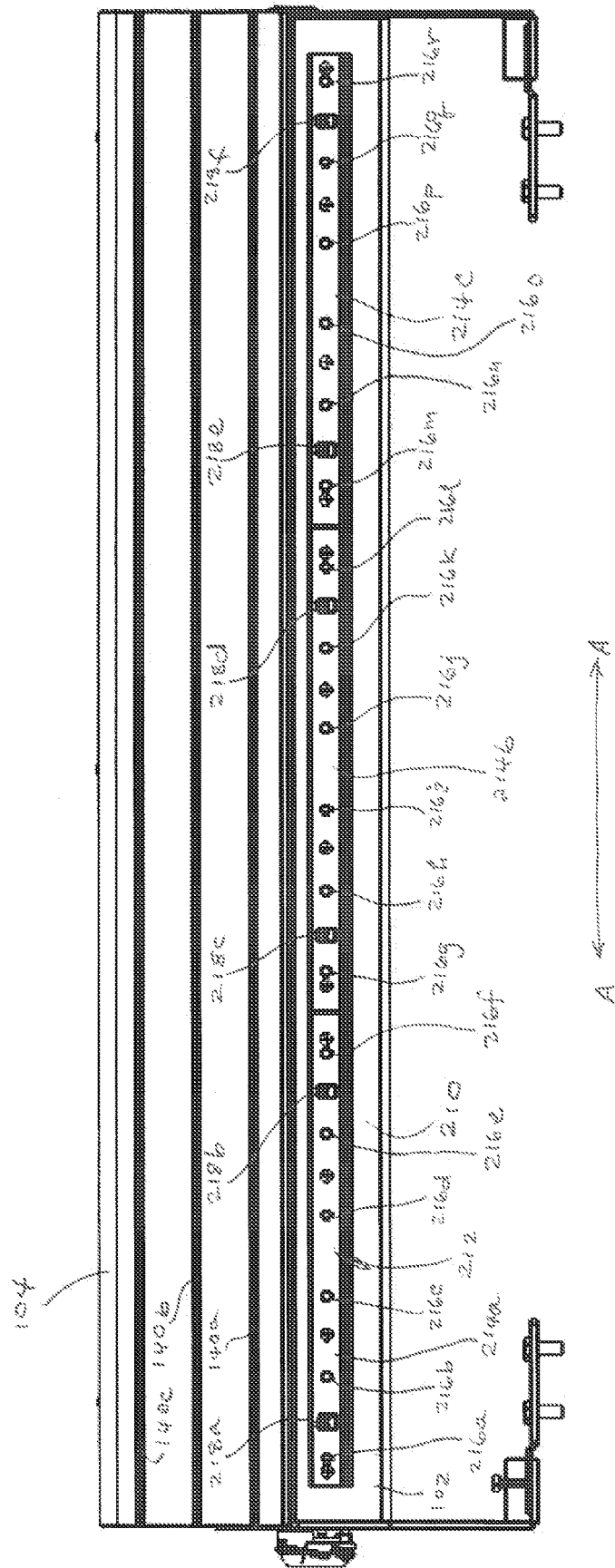


Fig. 3

FIG. 4



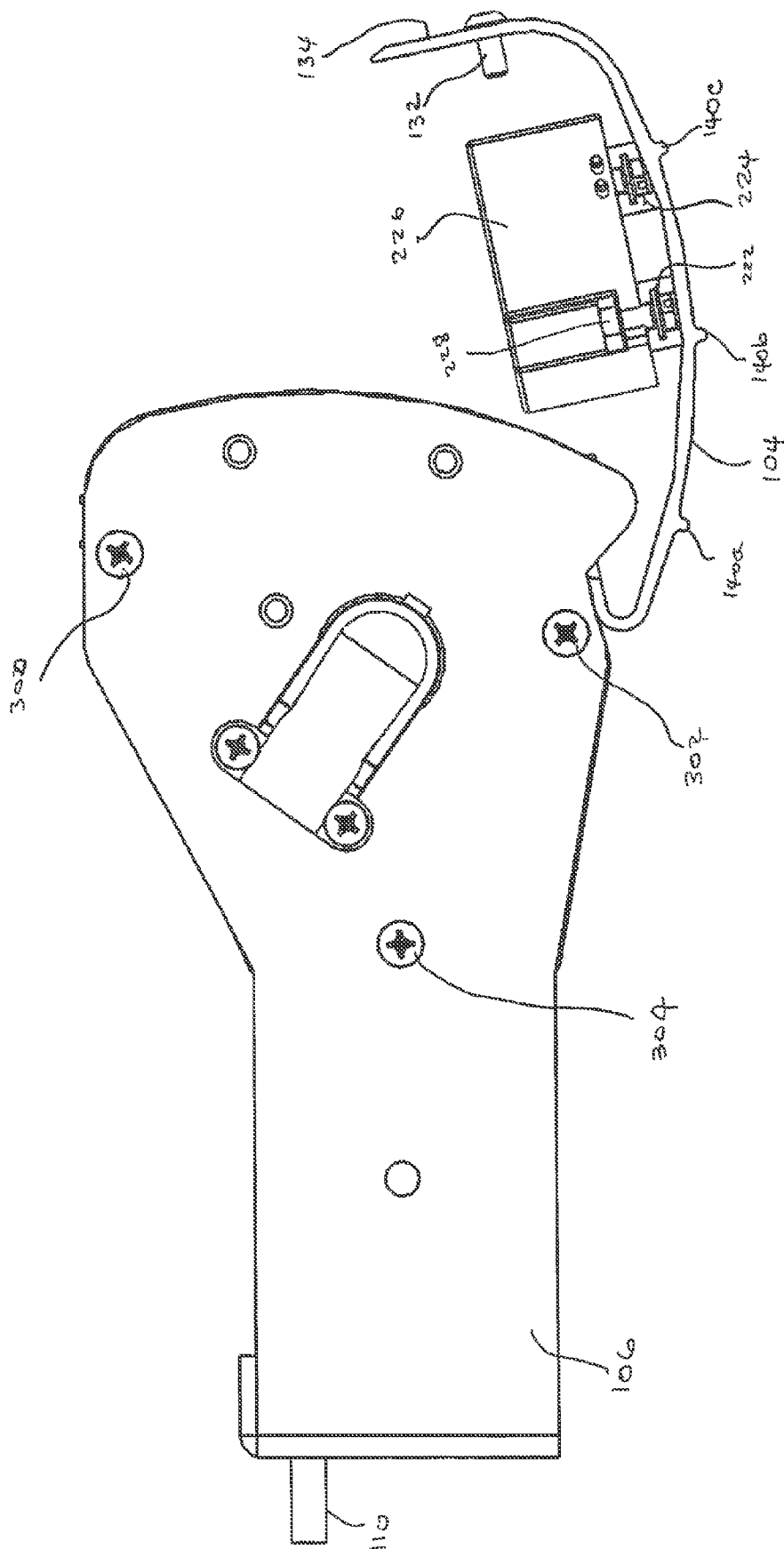
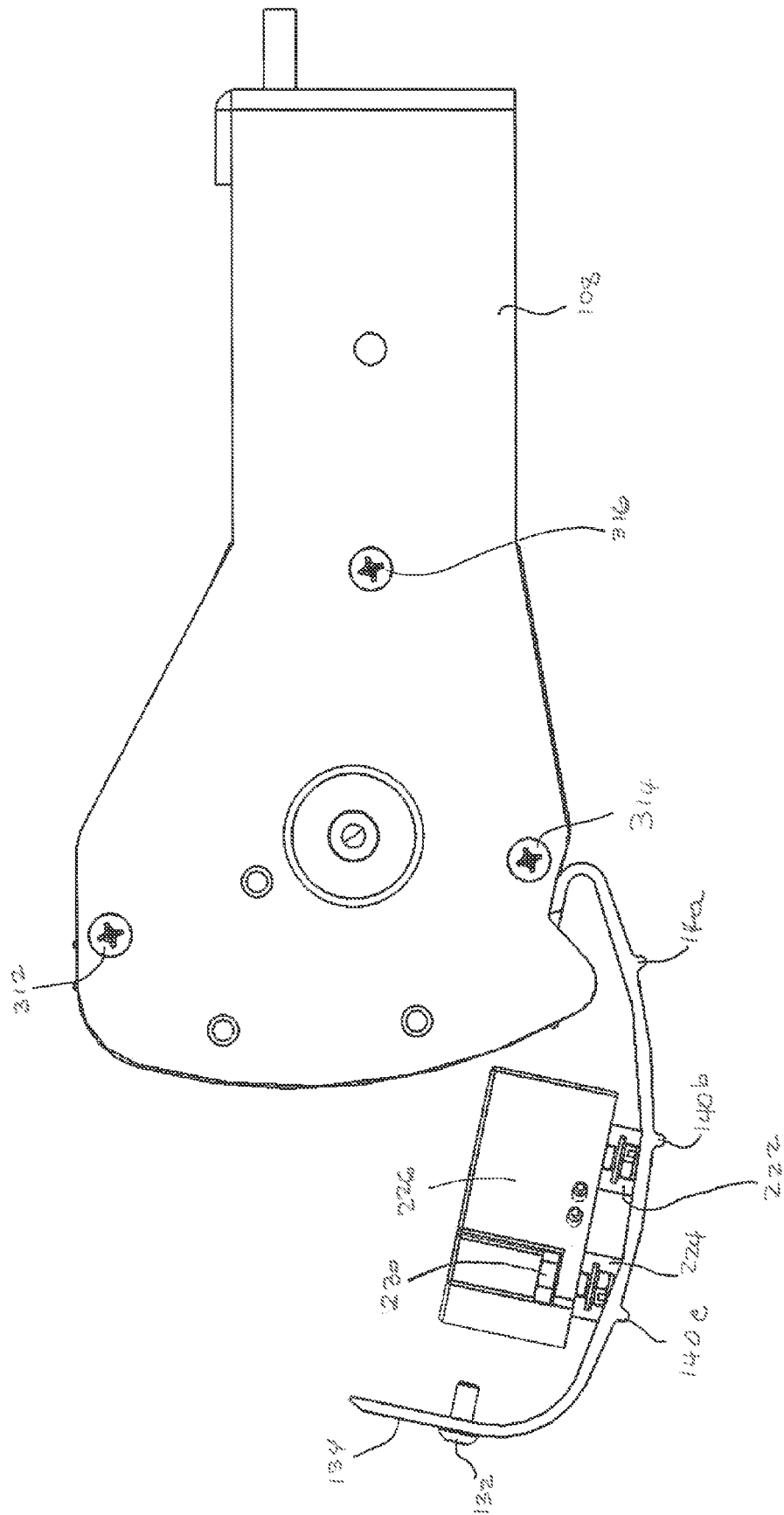


Fig 5



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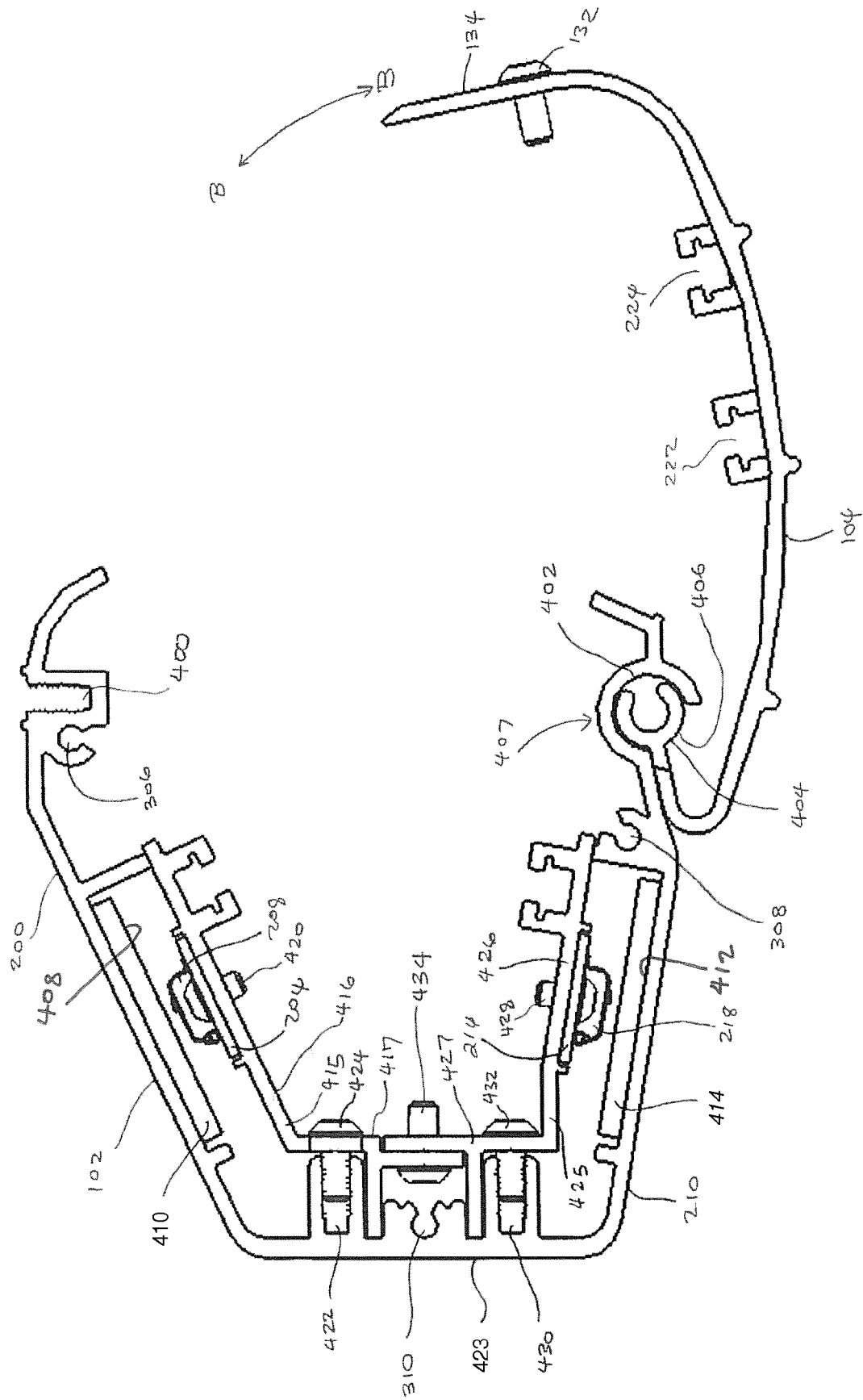
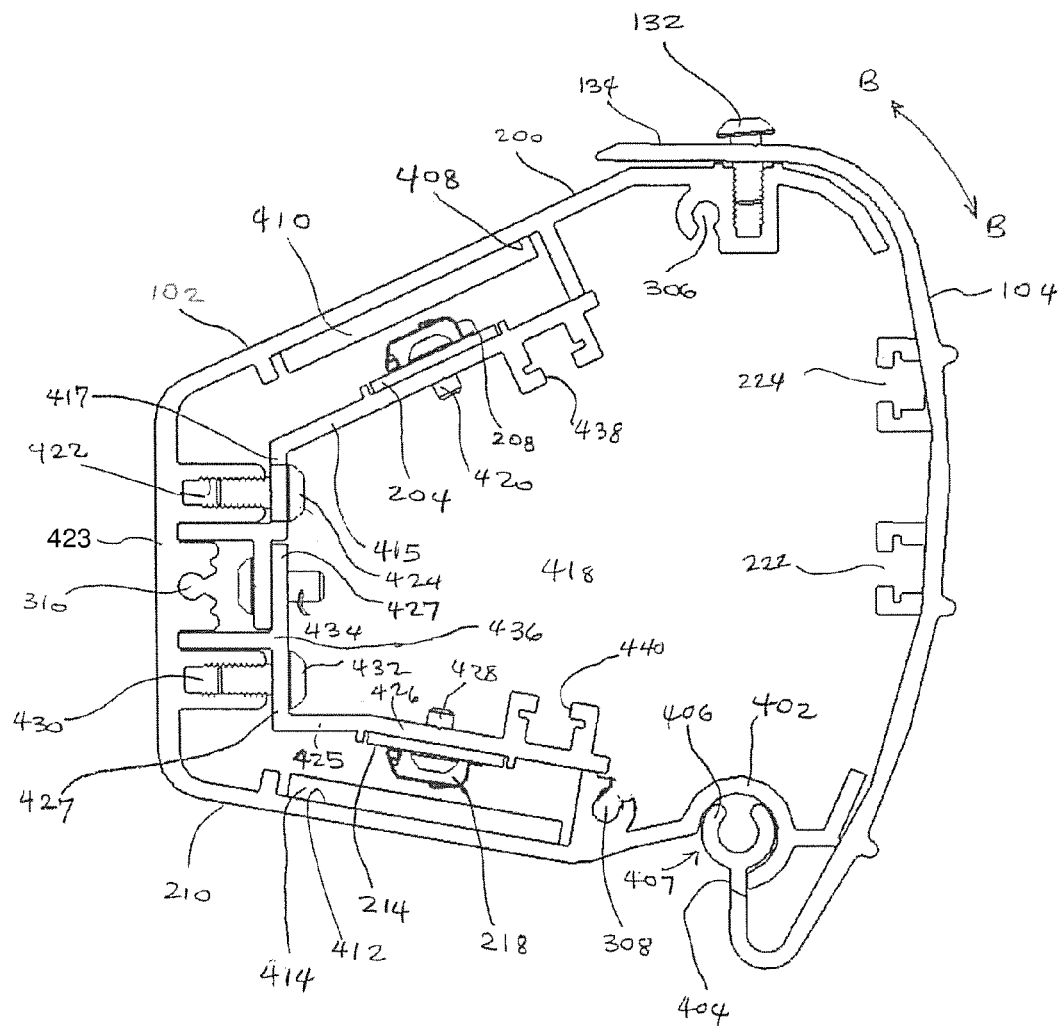


FIG. 7

FIG. 8



LINEAR LIGHTING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related generally to a lighting device, and more particularly a wallwash lighting device.

2. Description of the Background of the Invention

A lighting device is generally used to illuminate a space such as a room or a surface such as a wall, a ceiling, architectural element, signage, artwork, and the like. A typical lighting device includes a fixture, one or more light sources disposed in the fixture, and driver electronics to control the light sources. Traditionally, lighting devices have used fluorescent or incandescent light sources. Some lighting devices use solid-state light emitters including organic, inorganic, and polymer light emitting diodes (LEDs) as an energy-efficient alternative to the traditional fluorescent or incandescent light sources.

The LEDs used in lighting devices are typically high-powered solid-state emitters to provide a desired level of brightness. Because the lifetime of an LED is inversely related to the operating junction temperature thereof, thermal management of the junction temperature is an important design consideration of a lighting device that includes LEDs. Such a lighting device typically incorporates structures to transport heat from the LED junction and the driver electronics to the environment outside the lighting device.

A lighting device typically encloses the light source, driver electronics to control the light source, and cabling between the driver electronics and the light source within a housing of the light fixture. Such a lighting device typically includes a moveable cover that allows access to the components inside the light fixture for repair and/or periodic maintenance.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, a lighting device includes a body, a light source holder, and a light source. The body has a top portion, a bottom portion, and a rear portion. The light source holder has a holding member and an attachment member. The attachment member of the light source holder is secured to the rear portion of the body. Further, the light source is disposed on the holding member of the light source holder.

According to another aspect of the present invention a lighting device includes a body and a cover. The body has a top portion and a bottom portion. The cover has a first end and a second end and is movable between an open position and a closed position. The first end of the cover is pivotably secured to the bottom portion of the body and the second end of the cover is adapted to be fixedly secured to the top portion of the body.

Other aspects and advantages of the present invention will become apparent upon consideration of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a lighting device from above; FIG. 2 is another isometric view of the lighting device system of FIG. 1;

FIG. 3 is a top plan view of the lighting device of FIG. 1;

FIG. 4 is a bottom plan view of the lighting device of FIG. 1;

FIG. 5 is a left-side elevational view of the lighting device of FIG. 1;

FIG. 6 is a right-side elevational view of the lighting device of FIG. 1;

FIG. 7 is a cross-sectional view taken generally along the lines 7-7 of FIG. 2; and

FIG. 8 is a cross-sectional view taken generally along the lines 8-8 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1-8 illustrate an embodiment of a lighting device 100. Referring to FIGS. 1-8, the lighting device 100 includes a body 102, a cover 104, a left side plate 106, and a right side plate 108. It should be apparent that terms left and right (as well as other directional terms) are used herein to provide reference only and not to limit the embodiments described.

The left side plate 106 extends outwardly from the rear of the body 102 and includes a flange 110. The flange 110 extends towards the right from the left side plate 106. Similarly, the right side plate 108 extends outwardly from the rear of the body 102 and includes a flange 112. The flange 112 extends toward the left from the right side plate 108. The flanges 110 and 112 may be used to secure the lighting device 100 to a surface such as a wall, and the like. In particular, the flange 110 includes screw holes 114 and 116 through which screws 118 and 120, respectively, may be passed and secured to the surface. Similarly, the flange 112 includes screw holes 122 and 124 through which screws 126 and 128, respectively, may be passed and secured to the surface. It should be apparent that securing the flanges 110 and 112 to the surface in this manner secures the lighting device 100 to the surface. The flanges 110 and 112 may include fewer or more screw holes through which screws may be passed to affix the lighting device 100 to a surface. In addition, other ways of securing the lighting device 100 to the surface will be apparent to those who have skill in the art.

In some embodiments, the left side plate 106 may include a connector 130 that may be coupled to a conduit (not shown) that has a wire from a power source to supply electrical power to the lighting device 100. In other embodiments, the connector 130 may be disposed on the right side plate 108. In still other embodiments, such connectors 130 may be disposed on both the left side plate 106 and the right side plate 108. If the lighting device 100 is battery powered, the connector 130 may not be required.

Some embodiments of the lighting device 100 include screws 132 that secure a top portion 134 of the cover 104 to the body 102 when the cover 104 is in a closed position.

The body 102, cover 104, the left side plate 106, and right side plate 108 are typically constructed from a thermally conductive material such as aluminum or an aluminum alloy. It should be apparent that other thermally conductive materials may be used. Further, the body 102 and the cover 104 may be manufactured by extruding the thermally conductive material. Using a thermally conductive material facilitates the transfer of heat from inside the space formed by the body 102, cover 104, the left side plate 106, and the right side plate 108 to the exterior of the lighting device 100. In some embodiments, the left side plate 106 may include a wall 136 extending toward the right that provides support for the cover 104 when the cover 104 is in the closed position and also conducts heat between the left side plate 106 and the cover 104. Similarly, the right side plate 108 may include a wall 138 extending toward the left that provides support for the cover 104 and facilitates heat transfer.

In some embodiments, a sealing member (not shown), for example, a gasket may be secured to a surface of the left side

3

plate **106** and/or the right side plate **108** to seal the interior of the lighting device from the environment. For example, such seal may prevent water from entering the interior. Such surface may be a surface facing toward the body **102** or away from the body **102**. Further, a sealing member (not shown), for example, a strip gasket, may be adhered to one or more edges of the body **102** and/or the cover **104** to similarly seal the interior from the environment when the cover **104** is in a closed position. Such sealing members may be affixed to the left side plate **106**, the right side plate **108**, the body **102**, and/or the cover **102** using, for example, an adhesive such as a pressure sensitive adhesive. Other ways of affixing such sealing members will be apparent to those who have skill in the art.

In some embodiments, the cover **104** may include one or more ribs **140** that protrude outwardly therefrom and extend along the direction A-A.

Disposed on a top portion **200** of the body **102** is a window **202** that partially extends the length of the body **102** in the direction A-A. A first set of circuit boards **204** having LED light sources **206** secured thereto are disposed inside the body **102** such that the light emitted by the LEDs is projected outwardly through the window **202**. Further, although three circuit boards **204a**, **204b**, and **204c** are shown in FIG. 3, it should be apparent that more or fewer circuit boards **204** may be disposed in the body **102**. The circuit boards **204a**, **204b**, and **204c** do not each have to have an identical quantity of LED light sources **206** disposed thereon. For example, the circuit boards **204a** and **204c** each have four LED light sources **206** disposed thereon and the circuit board **204b** has six LED light sources **206** disposed thereon. Each circuit board **204** also has one or more terminal blocks **208** disposed thereon to distribute power from a driver unit (described below) to the LED light sources **206** disposed on such circuit board **204**.

Referring to FIG. 4, a bottom portion **210** of the body **102** also includes a window **212** disposed therein that partially extends the length of the body **102** in the direction A-A. A second set of circuit boards **214a**, **214b**, and **214c** having LED light sources **216** secured thereto are disposed inside the body **102** such that light emitted by the LED light sources **216** is projected outwardly through the window **212**. Each circuit board **214** includes one or more terminal blocks **218** disposed thereon to distribute power from the driver unit **226** to the LED light sources **216** disposed on such board **214**. Although FIG. 4 shows three circuit boards **214a**, **214b**, and **214c**, it should be apparent that more or fewer circuit boards **214** may be disposed in the body **102**.

Referring also to FIGS. 2, 3, 5, and 6, disposed on an inner surface **220** of the cover **104** are channels **222** and **224** that extend along the direction A-A. Each channel **222** and **224** includes inner walls so that a driver unit **226** may be secured to such channels **222** and **224** with screws **228** and **230**. In some embodiments, a bolt and nut may be used to secure the driver unit **226** to the channels **222** and **224**. For example, bolts may be inserted into each of the channels **222** and **224**, passed through mounting points in the driver unit **226**, and nuts fastened to the bolts to secure the driver unit **226** to the channels **222** and **224**. Other ways of the securing the driver unit **226** to the channels **222** and **224** will be apparent to those who have skill in the art. Electrical power supplied from an external power source, for example, through the wire in the conduit coupled to the connector **130**, may be directed by wiring (not shown) to the driver unit **226**. The driver unit **226** converts the power from alternating current to direct current (if necessary), adjusts the voltage and/or current of the power as necessary, and supplies the converted and/or adjusted

4

power to the terminal blocks **208** and **218**. As described above, the terminal blocks **208** and **218** distribute such supplied power to the LED light sources **206** and **216**, respectively. It will be apparent to one of skill in the art how to configure a driver unit **226** to convert power from a power source to power provided to the terminal block **208** and **218**, and also how to distribute power from the terminal blocks **208** and **218** to the LED light sources **206** and **216**, respectively.

Referring to FIGS. 5-8, the left side plate **106** is secured to the body **102** by screws **300**, **302**, and **304**. In particular, the screw **300** secures the left side plate **106** to a threaded channel **306** disposed in the top portion **200** of the body **102**. The screw **302** secures the left side plate **106** to a channel **308** disposed in the bottom portion **210** of the body **102**. The screw **304** secures the left side plate **106** to a channel **310** disposed in a rear portion **423** of the body **102**. In some embodiments, the top portion **200**, the bottom portion **210** and the rear portion **423** comprise a contiguous body **102**. In some cases, such contiguous body **102** is manufactured as a single extrusion. In other embodiments, the body **102** may comprise separate top, bottom, and rear portions, **200**, **210**, and **423**, respectively, that are joined to one another.

The channels **306**, **308**, and **310** extend the entire length of the body **102** in the direction A-A. The right side plate **108** is secured to the body **102** by fastening screws **312**, **314**, and **316** to the channels **306**, **308**, and **310**, respectively.

Note, the cross-sectional views of FIGS. 7 and 8 omit the driver unit **226** for sake of clarity.

Referring to FIGS. 1, 7 and 8, the top portion **200** of the body **102** includes a threaded channel **400** that extends the length of the body **102** in the direction A-A. The threaded channel **400** provides a receptacle into which the screw **132** may be fastened when the cover **104** is in a closed position.

Disposed in the bottom portion **210** of the body **102** are one or more semi-cylindrical portions **402**. In some embodiments, one semi-cylindrical portion **402** extends the length of the body **102** in the direction A-A. In other embodiments, a plurality of semi-cylindrical portions **402** is disposed along the length of the body **102**, with gaps therebetween.

Disposed at one end **404** of the cover **104** are one or more semi-cylindrical portions **406**. Each such semi-cylindrical portion(s) **406** corresponds to a semi-cylindrical portion **402** disposed in the body **102**. The diameter of the semi-cylindrical portion **406** is smaller than the diameter of the semi-cylindrical portion **402** such that the semi-cylindrical portion **406** may be nested inside of the semi-cylindrical portion **402**. Nesting the semi-cylindrical portions **402** and **406** in this manner form a hinge **407** that allows the cover **104** to pivot in the direction B-B about the semi-cylindrical portion **406** in the direction B-B. Such pivoting allows the cover **104** to be transported between an open position (as shown in FIG. 7) and a closed position (as shown in FIG. 8).

Disposed on an underside **408** of the top portion **200** of the body **102** is a lens **410** that covers the window **202**. The lens **410** is larger than the window **202** and extends beyond the window **202** in the direction A-A and in direction perpendicular thereto. The portions of lens **410** that extend beyond the length and width of the window **202** are secured by an adhesive to the underside **408** of the top portion **200** of the body **102**. In one embodiment, a silicone adhesive is used to secure the lens **410** to the underside **408** of the body **102**. Other suitable adhesives will be apparent to those who have skill in the art.

Disposed on an underside **412** of the bottom portion **210** of the body **102** is a lens **414**. The lens **414** covers the window **212**. The width and the length of the lens **414** are larger than the width and the length, respectively, of the window **212**. The

portions of the lens 414 that extend beyond the window 212 are secured by an adhesive to the underside 412 of the bottom portion 210 of the body 102.

The circuit boards 204 are disposed on a top board holder 415, as shown in FIG. 8. The top board holder 415 includes a holding member 416 and an attachment member 417. The top board holder 415 is disposed in volume 418 formed by the body 102 and cover 104. Each circuit board 204 is secured to the holding member 416 of top board holder 415 by one or more screws 420. Further, the top board holder 415 is disposed such that the LED light sources 206 disposed on the circuit boards 204 are aligned with the lens 410 and the window 202. A threaded channel 422 is disposed on the rear portion 423 of the body 102. The threaded channel 422 extends the length of the body 102 along the direction A-A. The attachment member 417 of the top board holder 415 is secured to the rear portion 423 of the body 102 by threading one or more screws 424 through the top board holder 415 and into the threaded channel 422. In some embodiments, the holding member 416 of the top board holder 415 is substantially parallel to at least a part of the top portion 200 of the body 102. Further, in some cases, the attachment member 417 of the top board holder 415 is substantially parallel to the rear portion 423 of the body 102.

A bottom board holder 425 is also disposed in the volume 418. The bottom board holder 425 includes a holding member 426 and an attachment member 427. Each circuit board 214 is secured to the holding member 426 of the bottom board holder 425 by one or more screws 428. The bottom board holder 425 is disposed such that the LED light sources 216 secured to the circuit board 214 are aligned with the lens 414 and the window 212. A threaded channel 430 is disposed on the rear portion 423 of the body 102 and extends the length of the body 102 in the direction A-A. The attachment member 427 of the bottom board holder 425 is secured to the rear portion 312 by threading a screw 432 through the bottom board holder 425 and into the channel 430. In some embodiments, the holding member 426 of the bottom board holder 425 is substantially parallel to at least a part of the bottom portion 210 of body 102. In addition, in some cases, the attachment member 427 of the bottom board holder 425 is substantially parallel to the rear portion 423 of the body 102.

A screw 434 secures the attachment member 417 of the top board holder 415 and the attachment member 427 of the bottom board holder 425 to one another. Like the body 102 and the cover 104, the top board holder 415 and the bottom board holder 425 are manufactured by extrusion of a thermally conductive material.

In some embodiments, the top board holder 415 and the bottom board holder 425 are secured to one another to form a unit 436. The attachment portions 417 and 427 of the top board holder 415 and the bottom board holder 425, respectively, combine to form a rear portion 437 of the unit 436. The screws 424 and 432 secure the rear portion 437 of the unit 436 to the rear portion 312 of the body 102. The unit 436 may be detached from the body 102 for maintenance by removing the screws 424 and 432. Such maintenance may include, for example, repair and/or replacement of the circuit boards 204 and 214 disposed on the board holders 415 and 425, respectively. Such maintenance may also include cleaning and or repair areas of the body 102 or the unit 436 that are difficult to access when the unit 436 is secured to the body 102. After the maintenance is completed, the unit 436 may be secured again to the body 102 using the screws 424 and 432. In some cases, the unit 436 may be extruded as a single piece instead of being formed using two discrete pieces and secured to the rear portion 423 by the screws 424 and 432.

Channels 438 and 446 may be disposed in the unit 436 to guide wiring (not shown) from the driver unit 226 to the circuit boards 204 and 214, respectively.

Because the body 102, the cover 104, the top board holder 415 and the bottom board holder 425 are manufactured from thermally conductive material, these components act as heat sinks and heat generated by the LED light sources 206 and 216 and the driver unit 226 is distributed into these components and dissipated to the environment outside the lighting device 100. Similarly, if the lighting device 100 comprises a unit 436 extruded as a single piece, such unit also acts as a heat sink and draws heat generated by the LED light sources 206 and 216 away therefrom and to the exterior of the lighting device 100. Further, because the hinge 407 is disposed at the bottom-front of the body 102, and therefore at the bottom-front of the lighting device 100, the cover 104 opens to provide access to the volume 418 from the front of the lighting device 100. Such access allows an operator to clean the interior volume 418 and replace or otherwise perform maintenance on the components of the lighting device 100.

INDUSTRIAL APPLICABILITY

Numerous modifications to the lighting device will be apparent to those skilled in the art in view of the foregoing description. Accordingly, this description is to be construed as illustrative only and is presented for the purpose of enabling those skilled in the art to make and use the lighting device and to teach the best mode of carrying out same. The exclusive rights to all modifications which come within the scope of the appended claims are reserved.

We claim:

1. A lighting device, comprising:

- a body having a top portion, a bottom portion, and a rear portion;
- a light source holder having a holding member and an attachment member, the attachment member of the light source holder is secured to the rear portion of the body;
- a light source, wherein the light source is disposed on the holding member of the light source holder;
- a cover having one end pivotably attached to the body;
- a lens separate from the cover and secured to the body, wherein light emitted by the light source passes through the lens; and
- a driver unit for controlling the light source, wherein the driver unit is secured to the cover and the cover conducts heat generated by the driver unit to the body.

2. The lighting device of claim 1, wherein the light source holder is disposed such that the holding member is parallel to a portion of one of the top portion or the bottom portion of the body.

3. The lighting device of claim 1, further comprising a second light source, and a second light source holder having a holding member and an attachment member, wherein the second light source is disposed on the holding member of the second light source holder and the second light source holder is secured to the rear portion of the body.

4. The lighting device of claim 3, wherein the light source holder and the second light source holder are coupled to one another to form a unit.

5. The lighting device of claim 4, wherein the unit may be inserted and removed from the body without decoupling the light source holder and the second light source holder.

6. The lighting device of claim 1, further comprising a window disposed on a portion of the body, and the light source holder is disposed such that the light source is aligned with the window.

7

7. The lighting device of claim 6, further comprising a second window disposed on a second portion of the body, a second light source, and a second light source holder, wherein the second light source is disposed on the second light source holder and the second light source holder is disposed such that the second light source is aligned with the second window.

8. The lighting device of claim 1, wherein the one end of the cover is pivotally attached to the bottom portion of the body.

9. The lighting device of claim 8, wherein another end of the cover is adapted to be fixedly attached to the top portion of the body.

10. The lighting device of claim 1, wherein the lens is non-pivotably attached to the body.

11. The lighting device of claim 8, wherein the cover and the body define an interior volume of the lighting device.

12. The lighting device of claim 8, wherein the light source holder is disposed in the interior volume.

13. The lighting device of claim 1, wherein the light source comprises a plurality of light emitting diodes disposed on a circuit board.

14. The lighting device of claim 1, wherein the holding member of the light source holder is substantially parallel to a portion of the top portion of the body.

15. The lighting device of claim 14, comprising a holding unit, wherein the light source holder forms a first portion of the holding unit and the holding unit includes a second portion that is substantially parallel to the bottom portion of the body.

16. The lighting device of claim 1, wherein the holding member of the light source holder is substantially parallel to a portion of the bottom portion of the body.

17. The lighting device of claim 1, wherein the attachment member of the light source holder is substantially parallel to the rear portion of the body.

18. The lighting device of claim 1, wherein the light source holder comprises a thermally conductive material.

19. The lighting device of claim 18, wherein the thermally conductive material conducts thermal energy away from the light source.

20. A lighting device, comprising:

a body having a top portion and a bottom portion;

a cover having a first end and a second end, wherein the cover is pivotably movable between an open position and a closed position;

a lens separate from the cover and secured to the body;

a light source, wherein light emitted by the light source passes through the lens;

a driver unit for controlling the light source, wherein the driver unit is secured to the cover and the cover conducts heat generated by the driver unit to the body; and wherein the first end of the cover is pivotably secured to the body and the second end of the cover is adapted to be fixedly secured to the body.

21. The lighting device of claim 20, wherein at least one of the body and the cover is manufactured from a thermally conductive material.

22. The lighting device of claim 20, wherein the light source comprises a first set of light sources positioned to direct light outwardly from the top portion of the body.

23. The lighting device of claim 22, further comprising a second set of light sources positioned to direct light outwardly from the bottom portion of the body.

24. The lighting device claim 23, further comprising a holding unit having a first light source holder and a second light source holder, wherein the first set of light sources is secured to the first light source holder, the second of set of

8

light sources is secured to the second light source holder, and the first light source holder is substantially parallel to the top portion of the body.

25. The lighting device of claim 24, wherein the second light source holder is substantially parallel to the bottom portion of the body.

26. The lighting device of claim 23, wherein the first set of light sources and second set of light sources are enclosed by the cover and the body.

27. The lighting device of claim 22, wherein the lens is non-pivotably secured to the body.

28. The lighting device of claim 22, wherein the first set of light sources comprises a light-emitting diode.

29. The lighting device of claim 20, wherein the second end of the cover is fixedly secured to the top portion of the body.

30. The lighting device of claim 20, wherein the cover is pivotably secured to the body by a hinge formed by the body and the cover.

31. The lighting device of claim 30, wherein the hinge comprises a semi-cylindrical portion of the body.

32. The lighting device of claim 31, wherein the hinge further comprises a semi-cylindrical portion of the cover.

33. The lighting device of claim 32, wherein the hinge is formed by nesting the semi-cylindrical portion of the cover inside the semi-cylindrical portion of the body.

34. A lighting device, comprising:

a body having a top portion, a bottom portion, and a rear portion;

a cover coupled to the body, wherein one end of the cover is pivotably attached to the body;

a thermally conductive light source holder coupled to the body;

a lens separate from the cover and secured to the body;

a light source disposed on the thermally conductive light source holder, wherein the thermally conductive light source holder conducts heat generated by the light source to the body and the cover, and light emitted by the light source passes through the lens; and

a driver unit for controlling the light source, wherein the driver unit is secured to the cover and the cover conducts heat generated by the driver unit to the body.

35. The lighting device of claim 34, wherein the body and the cover dissipate heat conducted thereto to an environment where the lighting device is disposed.

36. The lighting device of claim 34, comprising a second thermally conductive light source holder secured to the rear portion of the body.

37. The lighting device of claim 36, wherein the thermally conductive light source holder conducts heat generated by the light source to the second thermally conductive light source holder.

38. The lighting device of claim 36, comprising a second light source disposed on the second thermally conductive light source holder, wherein the second thermally conductive light source holder conducts heat generated by the second light source to the body and the cover.

39. The lighting device of claim 34, wherein a second light source is disposed on the thermally conductive light source holder.

40. The lighting device of claim 34, wherein the lens is non-pivotably secured to the body.

41. The lighting device of claim 34, wherein the cover is adapted to be secured to the top portion of the body.

42. The lighting device of claim 41, wherein the cover is pivotably secured to the bottom portion of the body.

43. The lighting device of claim **34**, comprising a side plate coupled to the body and the cover, wherein heat generated by the light source is conducted to the side plate.

44. The lighting device of claim **43**, comprising a second side plate couple to the body and the cover, wherein heat generated by the light source is conducted to the second side plate.

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